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Seat No.	

T.E. (Chemical) (Semester – I) Examination, 2014
CHEMICAL PROCESS TECHNOLOGY
(2012 Course)

Time : 3 Hours Max. Marks : 70

Instructions : *1) Answer **any five** questions.*
*2) **Neat** diagrams must be drawn **wherever** necessary.*
*3) Black figures to the **right** indicate **full** marks.*
*4) Assume suitable data, if **necessary**.*

1. With the reactions for Cl_2 and NaOH production, describe the electrolytic process for chlorine and caustic soda production. **10**

OR

2. a) Describe the production of Bromine from sea water. **5**
   b) Explain the production of common salt from sea water. **5**

3. Draw and explain the production of sulfuric acid by DCDA process. Also enlist the major engineering problems involved in it. **10**

OR

4. Draw and explain the production of ethyl alcohol by fermentation of molasses. **10**

5. Explain how cleaning action taken place when soap or detergents are used and discuss the production of soap. **10**

OR

6. Explain how oil is extracted from natural raw materials with neat diagram. **10**

7. a) Write a note on refinery operations. Explain alkylation in detail. **10**
   b) Discuss the production of water gas and producer gas. **10**

OR

8. a) Draw neat flow diagram and discuss in brief : **10**
      1) Polymerization
      2) Reforming.
   b) Draw and explain the fluidized bed type catalytic cracking process. **10**

P.T.O.

9. a) Explain the production of formaldehyde from methanol with neat diagram. **10**

   b) Explain the production of vinyl chloride via ethylene dichloride. **10**

OR

10. a) Draw and explain the production of cumene via propylene alkylation of benzene. **10**

    b) Illustrate the following with neat diagram (**any one**) : **10**

    1) Production of phenol by cumene process.
    2) Production of phenol by raschig process.
    3) Production of phenol by toluene – oxidation process.
    4) Production of phenol by benzene sulfonate process.

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T.E. (Chemical) (Semester – I) Examination, 2014
INDUSTRIAL ORGANISATION AND MANAGEMENT
(2012 Pattern)

Time : 3 Hours

Max. Marks : 70

Instructions : *1) **Neat** diagrams must be drawn **wherever** necessary.*
*2) Black figures to the **right** indicate **full** marks.*
*3) Assume suitable data, if **necessary**.*
*4) Attempt Q. **1** or Q. **2**, Q. **3** or Q. **4**, Q. **5** or Q. **6**, Q. **7** or Q. **8**, Q. **9** or Q. **10**.*

1. a) Explain partnership with advantages and disadvantages. 6
   b) Write a note on Merit Rating. 4

OR

2. Explain with a neat sketch Line and Staff Organization along with advantages. 10
3. a) Explain different types of wages. 6
   b) Explain in detail recruitment. 4

OR

4. Explain various functions of storekeeper. 10
5. a) What is sales forecasting ? Explain the two types of sales forecasting in detail. 8
   b) Explain any two Pricing Strategies in detail. 8

OR

6. a) Explain in detail Marketing Mix. 8
   b) Write an explanatory note Advertising. 8
7. a) Write notes on : 8
      i) Antidumping Duty
      ii) International Trade.
   b) Explain in detail Total Quality Management of a process industry. 8

OR

8. a) Explain Quality Circle. 8
   b) Explain in detail various factors affecting International Trade. 8

P.T.O.

9. Write short notes on : **18**
   i) MRTP
   ii) FERA and FEMA
   iii) Flow Chart and Flow Diagram.

OR

10. a) Explain the term Agreement in Contract Act. Explain the various types of contract according to enforceability, formation and performance. **12**
    b) Write note on Patent and Patent Rights. **6**

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Seat No.	

T.E. (Chemical) (Semester – I) Examination, 2014
MASS TRANSFER – I
(2012 Course)

Time : 3 Hours Max. Marks : 70

Instructions : *1) Answer Q. **1** or Q. **2**, Q. **3** or Q. **4**, Q. **5** or Q. **6**, Q. **7** or Q. **8**, Q. **9** or Q. **10**.*
*2) **Neat** diagrams must be drawn **wherever** necessary.*
*3) Figures to the **right** side indicate **full** marks.*
*4) Assume suitable data if **necessary**.*

1. a) What are the General Principles of Mass Transfer ? Explain importance of Mass Transfer operations. 4

   b) Ammonia gas (A) is diffusing through a uniform tube 0.10 m long containing Nitrogen gas (B) at 1.0132×10^5 Pa pressure and 298 K. At point one $P_{A1} = 1.013 \times 10^4$ Pa and at point two $P_{A2} = 0.507 \times 10^4$ Pa. The diffusivity $D_{AB} = 0.23 \times 10^{-4}$ m^2/sec. Calculate the flux at steady state. ($R = 8.314$ KPa m^3/Kmol.K) 6

   OR

2. a) What is Mass transfer coefficient ? Explain. 4

   b) A tube 1 cm in inside diameter that is 20 cm long is filled with carbon dioxide (A) and hydrogen (B) at 2 atm total pressure at 0° C. The diffusion coefficient under these conditions is 0.275 cm^2/sec. If the partial pressure of carbon dioxide is 1.5 atm. at one end and 0.5 atm. at the other end. Find the rate of diffusion for steady state diffusion of carbon dioxide through stagnant hydrogen ? 6

3. a) What are the different theories of Mass Transfer ? Explain Dankwerts Surface renewal theory. 4

   b) Derive an equation for operating line for counter current absorption process and show it graphically. 6

   OR

4. a) Explain Minimum Liquid/Gas (L/G) ratio for Absorption. 5

   b) Explain absorption and stripping factor. 5

5. a) Explain vapour pressure of water and physical states.

   b) An air-water sample has DBT 50° C and 35° C. Using humidity chart, calculate, 6
      i) Humidity ii) Dew point iii) % relative humidity
      iv) Humid heat v) Humid Volume. 10

   OR

P.T.O.

6. a) Define, 1) Absolute humidity, 2) Saturation humidity, 3) Percentage humidity, 4) Relative humidity. **8**

   b) Derive the equation for height of cooling tower as Z = HTU × NTU. **8**

7. a) What are the various equipment's used for gas-liquid contact ? With neat sketch explain Venturi Scrubber and Spray Towers. **8**

   b) Explain mechanically agitated vessels with different types of impellers. **8**

OR

8. a) Explain wetted wall column and its application. **8**

   b) Give comparison between Tray and Packed column. **8**

9. a) What is Drying ? Give classification of dryers and purposes of drying operation. **8**

   b) A batch of solid for which the following table of data applies is to be dried from 25% to 6% (wet basis) moisture under conditions identical to those for which the data were tabulated. The initial weight of the wet solid is 300 kg and the drying surface is 1 m^2/8 kg dry weight. Determine the time for drying. **10**

X kgmoist./Kg dry solid	0.35	0.25	0.20	0.18	0.16	0.14	0.12	0.10	0.09	0.08	0.064
R Kg moist./hr.m^2	0.3	0.3	0.3	0.266	0.239	0.208	0.18	0.15	0.097	0.07	0.025

OR

10. a) Explain rate of drying curves. **8**

    b) A porous dry solid was dried under constant drying conditions in a batch dryer. It took 5 hrs. to reduce the moisture from 30% to 10%. The critical moisture content is 16%, equilibrium moisture content is 2%. All the moisture content on dry basis. How long will it take to dry a sample of the above solid to dry from 36% to 6% under the same drying conditions ? **10**

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Seat No.	

T.E. (Chemical) (Semester – I) Examination, 2014
CHEMICAL ENGINEERING MATHEMATICS
(2012 Course)

Time : 3 Hours Max. Marks : 70

Instructions : 1) ***Neat*** *diagrams must be drawn* ***wherever*** *necessary.*
2) *Black figures to the* ***right*** *indicate* ***full*** *marks.*
3) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is* ***allowed.***
4) *Assume suitable data, if* ***necessary.***

1. a) Using bisection method find the root of the equation $X^3 - 1.8X^2 - 10X + 17 = 0$ that lies between the interval (1, 2) at the end of 2nd iteration. **5**

   b) Using Newton Raphson method and taking initial guess as zero. Find $X^3 - 5X + 3 = 0$. Perform two iterations only. **5**

   OR

2. a) Solve the following system of equations using Gauss Elimination method with partial pivoting. **5**

   $x + y + z = 6$
   $3x + 3y + 4z = 20$
   $2x + y + 3z = 13$

   b) Solve the following equations using Gauss Jordon method. **5**

   $x + y + z = 90$
   $x + 3y + 6z = 370$
   $3x - 8y - 4z = -340$

3. a) From the given data find the value of y at x = 4.5. **5**

x	1	2	3	4	5
y	2.38	3.65	5.85	9.95	14.85

   b) Evaluate $\log_e 7$ (logarithm of 7 to base e) by Simpson's 1/3rd rule. **5**

   OR

P.T.O.

4. a) Solve the following equations using Gauss Seidal method. (perform 2 iterations only) 5

$4x + y + z = 5$

$x + 6y + 2z = 19$

$x + 2y + 5z = -10$

b) The following data are from the steam table 5

Temperature °c	140	150	160	170
Pressure Kgf/Cm²	3.685	4.854	6.302	8.076

Using Newtons backward formula find the pressure of steam for temperature of 142°C.

5. a) Explain the graphical interpretation of Eulers method. 8

b) Solve the differential equation $dy/dx = 1 + xy$ at $x = 0.1$ and $x = 0.2$ using modified Euler's method subject to boundary condition $y(0) = 1$ upto accuracy of 0.001. 8

OR

6. a) Discuss the stability region of Runge Kutta method. 8

b) Solve the following equation by Runge-Kutta 4^{th} order method at $x = 0.8$. 8

$dy/dx = y - x$

Take $x_0 = 0$, $y(0) = 2$, $h = 0.2$.

7. Solve the boundary value problem 16

$d^2y/dx^2 + y = 0$ with boundary conditions

$y = 0$ when $x = 0$

$y = 0$ when $x = 1$. Find y at $x = 0.5$.

OR

8. A steel plate of 750 x 750 mm has its two adjacent sides maintained at 100 degree C. While the two other sides are maintained at 0 degree C. What will be the steady state temperature at interior points assuming a grid size of 250 mm ? 16

9. Suppose that a gas processing plant receives a fixed amount of raw gas each week. The raw gas is processed into two grades of heating gas, regular and premium quality. These grades of gas are in high demand and yield different profit to the company. However there production involves both time and on-site constraints. For example only one of the grade can be produced at a time and the facility is open for only 80 hrs/week. Further there is limited on site storage for each of the products. All factors are listed below. **18**

	Product		
Resource	**Regular**	**Premium**	**Resource Availability**
Raw gas	7 m^3/tonne	11 m^3/tonne	77 m^3/week
Production time	10 hr/tonne	8 hr/tonne	80 hr/week
Storage	9 tonnes	6 tonnes	
Profit	150/tonne	175/tonne	

Develop a linear programming formulation to maximize the profits for this operation.

OR

10. a) Explain the scanning and bracketing procedures for optimization of unconditional functions of one dimensional search. **10**

b) What are the six steps of Optimization ? **8**

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Seat No.	

T.E. (Chemical Engineering) (Semester – I) Examination, 2014
CHEMICAL ENGINEERING THERMODYNAMICS – II
(2012 Course)

Time : 3 Hours Max. Marks : 70

Instructions : *1) Answer Q. **1** or Q. **2**, Q. **3** or Q. **4**, Q. **5** or Q. **6**, Q. **7** or Q. **8**, Q. **9** or Q. **10**.*
*2) Neat diagrams must be drawn **wherever** necessary.*
*3) Figures to the **right** side indicate **full** marks.*
*4) Assume suitable data if **necessary**.*

1. Show that the fugacity of gas obeying the Van der Walls equation of state is given by **10**

$$\ln f = \frac{b}{V-b} - \frac{2q}{RTV} + \ln \frac{RT}{V-b}$$

where a and b are Van der Walls constants.

OR

2. Calculate the partial molar volumes of methanol and water in 40% (mol) methanol solution give the following data at 1 bar and 298 K. (x = mole fraction of methanol). **10**

X	0	0.114	0.197	0.249	0.495	0.692	0.785	0.892	1.0
VX 10^3 m^3/mol	0.0181	0.0203	0.0219	0.023	0.0283	0.0329	0.0352	0.0379	0.0407

3. The volume of mixture of two organic liquids 1 and 2 is given by **10**

$$V = 110.0 - 17\,x_1 - 2.5\,x_1^2$$

where V is the volume in m^3/mol at 1.0 bar and 300 K. Find the expression for $\overline{V1}, \overline{V2}$ and ΔV.

OR

4. a) A vessel is divided into two compartments. One contains 100 moles nitrogen at 298 K and 1 bar and the other contains 100 moles of oxygen at the same conditions. The barrier separating them is removed and the gases are allowed to reach equilibrium under adiabatic conditions. What is the change in entropy of the contents of the vessel ? **5**

   b) Methanol (1)-acetone (2) system is described by the Van Laar activity coefficient model. At 60°C, the model parameters are $A_{12} = 0.47$; $A_{21} = 0.78$. Estimate the activity coefficients for a solution containing 10 mole% of methanol. **5**

P.T.O.

5. a) The azeotrope of the ethanol-benzene system has a composition of 44.8% (mol) ethanol with a boiling point of 341.4 k at 101.3 KPa. At this temperature the vapor pressure of ethanol is 68.9 KPa and the vapor pressure of ethanol is 67.4 KPa. What are the activity coefficient in a solution containing 10% alcohol ? **10**

b) Using the criterion of phase equilibrium show that the osmotic pressure over an ideal solution can be evaluated as $P_{osmotic} = \frac{RTXa}{Vb}$

where X_a is the mole fraction of solute and V_b is the molar volume of the solvent. **8**

OR

6. a) The vapour pressure of acetone acetonitrile and nitromethane can be represented by antoine equation as **10**

$$\ln P_1^{sat} = 14.3916 - \frac{2795.82}{T+230}$$

$$\ln P_2^{sat} = 14.2724 - \frac{2945.47}{T+224}$$

$$\ln P_3^{sat} = 14.2043 - \frac{2972.64}{T+209}$$

where P_{1sat}, P_{2sat} and P_{3sat} are KPa and T is in °C. Assuming that the solutions formed by these are ideal, calculate

i) P and y_1 at T = 75°C, $x_1 = 0.30$ $x_2 = 0.40$

ii) P and x_1 at T = 80°C, $y_1 = 0.45$, $y_2 = 0.35$

b) Derive various criteria for phase equilibrium. **8**

7. a) n-Butane is isomerized to i-butane by the action of catalyst at moderate temperatures it is found that the equilibrium is attend at the following composition. **8**

Temperature, K	Mole%, n-butane
317	31.00
391	43.00

Assuming that activities are equal to the mole function calculate the standard free energy of the reaction at 317 K and 391 K and average value heat reaction over this temperature range.

b) Derive Van't Hoff equation. **8**

OR

8. a) In, a laboratory investigation, acetylene is catalytically hydrogenated to ethylene at 1120°C and 1 bar. If the feed is an equimolar mixture of acetylene and hydrogen, what is the composition of the product stream at equilibrium ? **8**

   Reactions :

   $C_2H_2 \longrightarrow 2C + H_2$ (I)

   $2C + 2H_2 \longrightarrow C_2H_4$ (II)

   b) Derive the relationship between mole fraction of species in multiple reactions and the extent of reactions. **8**

9. a) Explain phase rule and Duhem's theorem for reacting system. **8**

   b) What is Fuel cell ? Show that work obtainable from the electrochemical device is equal to change in Gibbs free energy change. **8**

   OR

10. A mixture of 1 mol CO, and 1 mo, water vapour is undergoing the water-gas shift reaction at a temperature of 1100 K and a pressure of 1 bar. **16**

    $CO_{(g)} + H_2O_{(g)} \longrightarrow CO_{2(g)} + H_{2(g)}$

    The equilibrium constant for the reaction is K = 1. Assume that the gas behaves as ideal gas. Calculate

    A) The fractional dissociation of steam

    B) The fractional dissociation of steam if CO supplied is 100% excess of the stoichiometric requirement.
